

### Penetration-resistant material and articles made of the same

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#### Claims:

1. A penetration-resistant material comprising at least a double layer of woven fabric wherein the double layer comprises a first layer of fabric composed of a first set of threads comprising 3.5 to 20 threads/cm, having a linear density of at least 210 dtex, and comprising at least 65 % of the fabric weight, and a second set of threads comprising 0.5 to 16 threads/cm and having a linear density of at least 50 dtex, with the second set of threads being transverse to the first set of threads, and the ratio of the number of threads/cm of the first set to that of the second set is  $> 1$ , and a second layer of fabric composed of a first set of threads comprising 0.5 to 16 threads/cm and having a linear density of at least 50 dtex, and a second set of threads comprising 3.5 to 20 threads/cm, having a linear density of at least 210 dtex, and comprising at least 65 % of the fabric weight, with the second set of threads being transverse to the first set of threads, and the ratio of the number of threads/cm of the second set to that of the first set is  $> 1$ , and wherein the first and second sets of threads of the first layer have a parallel orientation towards the first and second sets, respectively, of threads of the second layer, and wherein in the first layer of fabric at least the first set of threads and in the second layer of fabric at least the second set of threads are treated with a water-repellant.

2. The penetration-resistant material of claim 1 wherein in the first layer of fabric the first and the second set of threads and in the second layer of fabric the first and the second set of threads are treated with a water-repellant.
3. The penetration-resistant material of claim 1 or 2 wherein the water-repellant comprises fluor and carbon atoms.
4. The penetration-resistant material of claim 3 wherein the water-repellant comprises a mixture of fluoroacrylate polymers.
5. The penetration-resistant material of any one of claims 1 to 4 wherein the water-repellant treated threads comprise about 0.1 to about 2 weight % fluoroacrylate polymers with respect to the weight of the water-repellant treated threads.
6. The penetration-resistant material of any one of claims 1 to 5 wherein at least the ratio of the linear density of the first set of threads to the linear density of the second set of threads of the first layer and of the linear density of the second set of threads to the linear density of the first set of threads of the second layer is  $> 1$ .
7. The penetration-resistant material of claim 6 wherein at least the ratio of the linear density of the first set of threads to the linear density of the second set of threads of the first layer and of the linear density of the second set of threads to the linear density of the first set of threads of the second layer is  $> 4.2$ .
8. The penetration-resistant material of claim 6 or 7 wherein at least the ratio of the linear density of the first set of threads to the linear density of the second set of threads of the first layer and of the linear density of the second set of threads to the linear density of the first set of threads of the second layer is  $> 5.9$ .

9. The penetration-resistant material of any one of claims 1 to 8 wherein at least one of the second set of threads of the first layer and the first set of threads of the second layer comprises 0.5 to 8 threads/cm.
10. The penetration-resistant material of any one of claims 1 to 9 wherein the threads of the layers of the double layer are bonded together.
11. The penetration-resistant material of claims 10 wherein the threads of the layers of the double layer are bonded together with an adhesive material.
12. The penetration-resistant material of any one of claims 1 to 11 wherein the first set of threads of the first layer and the second set of threads of the second layer consist of high tenacity threads selected from aramid, polyethylene and poly-p-phenylenebenzobisoxazole (PBO) threads.
13. The penetration-resistant material of any one of claims 1 to 12 wherein the second set of threads of the first layer and the first set of threads of the second layer are selected from polyester, polyethylene, polypropylene and aramid threads.
14. The penetration-resistant material of any one of claims 1 to 13 wherein the first set of threads of the first layer and the second set of threads of the second layer consist of aramid threads, and the second set of threads of the first layer and the first set of threads of the second layer consist of polyester threads.
15. The penetration-resistant material of any one of claims 1 to 14 wherein the linear density of the first set of threads of the first layer and of the second set of threads of the second layer is 210 to 6720 dtex.

16. The penetration-resistant material of claim 15 wherein the linear density of the first set of threads of the first layer and of the second set of threads of the second layer is 420 to 3360 dtex.
17. The penetration-resistant material of claims 15 or 16 wherein the linear density of the first set of threads of the first layer and of the second set of threads of the second layer is 420 to 1680 dtex.
18. The penetration-resistant material of claims 15, 16 or 17 wherein the linear density of the first set of threads of the first layer and of the second set of threads of the second layer is 840 to 1100 dtex.
19. The penetration-resistant material of any one of claims 1 to 18 wherein the linear density of the second set of threads of the first layer and of the first set of threads of the second layer is 50 to 280 dtex.
20. The penetration-resistant material of claim 19 wherein the linear density of the second set of threads of the first layer and of the first set of threads of the second layer is 80 to 140 dtex.
21. The penetration-resistant material of any one of claims 1 to 20 wherein the first set of threads of the first layer and the first set of threads of the second layer are warp threads and the second set of threads of the first layer and the second set of threads of the second layer are weft threads.
22. The penetration-resistant material of any one of claims 1 to 21 wherein the double layer exhibits two outer sides and at least one of the outer sides of the double layer is provided with a protective layer.
23. An article made of the penetration-resistant material of any one of claims 1 to 22.